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SECTION III.—FORECASTS.

FORECASTS AND WARNINGS FOR JANUARY, 1917.

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[Dated: Washington, D. C., Feb. 23, 1917.]

The month was remarkable for the excess in numbers and speed of movement of LOWS and HIGHS that crossed the United States. The LOWS were 19 in number, of which 15 were of the Alberta, 1 of the North Pacific, 2 of the Colorado, and 1 of the East Gulf type. The HIGHS were 11 in number, of which 7 made their first appearance over Alberta, 1 off the North Pacific coast, 2 over the Rocky Mountain and Plateau region, and 1 south of Hudson Bay. The prevalence of high pressure over the Western Plateau and Rocky Mountains region was one of the distinct features of the daily weather maps during January. As may be inferred from the excessive number of HIGHS and LOWS, the weather during January was very changeable and temperature fluctuations were frequent and marked. Temperature departures from the monthly averages were positive over the Eastern and Southern States east of the Rocky Mountains and negative over the Northwestern States and generally west of the Rocky Mountains divide.

Daily reports from the Alaskan area showed barometer readings below the normal during the first decade of the month and again on the 21st; at all other times the readings were above the normal. This was particularly true during the intervals from the 10th to 17th and again from the 23d to the close of the month. Temperature in Alaska was below the normal during the greater part of the month. At Honolulu high pressure prevailed from the 1st to 9th and again on the 16th and 23d; at other times the pressure was below the normal at this station. The pressure over the western Atlantic was decidedly low in the vicinity of Newfoundland, and slightly above the normal in the region of Bermuda and the Greater Antilles.

For the United States as a whole the issue of special warnings of cold waves and frosts and of storm warnings for the coast districts was frequent because of the large number of cyclones and anticyclones. The most important of the cold waves appeared in the northwest toward the end of the month and thence spread eastward and southward over practically all parts of the country. This cold wave was especially severe during the early part of February in all Eastern and Southern States east of the Rocky Mountains. The warnings in connection with this severe cold wave were issued well in advance of its occurrence and unquestionably resulted in the saving of much live stock and produce, permitted protective action to be taken with regard to perishable shipments in transit and storage, and was otherwise helpful in many ways. The following special bulletin concerning this cold wave was issued on Wednesday, January 31:

Special Weather Bulletin.—Extraordinary weather conditions are depicted on the weather chart of Wednesday morning. Spring-like weather prevails in the Southern States, the Middle Mississippi Valley, Kentucky, and Tennessee, while a severe cold wave accompanied by temperature much below zero [F.] has overspread the Plains States and the Rocky Mountains and Western Plateau regions. Some of the below-zero temperatures recorded Wednesday morning were as follows:

Havre, Mont., -36° F.; Helena, Mont., -26° ; Yellowstone National Park, Wyo., -12° ; Sheridan, Wyo., -26° ; Williston, N. Dak., -36° ; Rapid City, S. Dak., -20° ; Valentine, Nebr., -18° ; and Moorhead, Minn., -16° . A storm of marked intensity was central Wednesday morning over Missouri and moving rapidly eastward; it has already been attended by snow in the Upper Lakes Region and the upper Mississippi Valley, and by snow and gales over the Plains States and the Rocky Mountains Region. The cold wave that follows this storm will overspread the Middle West and Southwest to-night and Thursday and the Eastern and Southern States Thursday night and Friday, and it will be severe and prolonged in nearly all districts east of the Rocky Mountains.

The following editorial appeared in the New Orleans Times-Picayune on February 4:

The freeze reported Friday and Saturday was one of the most widespread and general ever known in the United States and in many sections the most severe for years. At the same time, it did a minimum of harm, coming as it did, without any very squally weather. In and around New Orleans it was freezing weather for two full days and the coldest for five years; and in Tennessee the coldest for 18. At Nashville and Knoxville in that State the thermometer got under the zero point, a most unusual event for the sunny South. It was below zero at a dozen places; and only one section east of the Rockies, southern Florida, was reported above the freezing point, Tampa registering 46° .

The Weather Bureau is given due credit for early and correct warnings of the cold wave, the date of its arrival, and its intensity. It was possible therefore to make some preparations for it; and whenever this was possible it was done. In Florida, for instance, much of the exposed truck crop and early vegetables were covered or otherwise protected and saved. It was not possible to do this, however, in all cases and many of the vegetables growing around New Orleans and elsewhere were seriously injured by two days of such severe freeze. They might have lived through Friday had not Saturday followed so close behind with even colder weather. Lettuce, beets, tomatoes, parsley, and garden truck generally will be short for a time.

Fortunately, the freeze came at a season of the year neither too early nor too late—and it did, in consequence, a minimum of harm. The orange crop, which is easily affected by extreme cold weather, escaped all damage; and strawberries and other small fruit, while set back a little, were not injured. In the severity of the cold and the area covered it was one of the greatest freezes known in this country; in the damage done and the amount of suffering caused, it was of little moment, and indeed it may prove of advantage, as freezes usually do, in reducing the evils and losses from insects by destroying a large number of the boll weevils and other destructive species.

Next in importance to the cold wave already referred to was the series of marked falls in temperature that occurred during the second decade of the month, at a time when the pressure was abnormally high over eastern and southern Alaska and low over the Hawaiian Islands, a pressure distribution that is nearly always in evidence preceding and attending marked cold waves in the United States east of the Rocky Mountains.

Washington District.—The month of January opened with moderate temperatures, overcast weather, and general rains. On the 3d a disturbance of moderate intensity was central in the region of the Great Lakes, whence it moved eastward during the night of that day to the southern New England coast, attended by snow in New England and strong shifting winds on the Atlantic coast north of Delaware Breakwater. Storm warnings were issued the morning of the 3d for this region and at 10 p. m. of that day, the storm having passed to sea, the warnings were lowered. On the morning of the 4th there were indications of the development of a disturbance over northern Texas and Oklahoma. On the morning of the 5th the center of this disturbance had advanced rapidly eastward to the upper Ohio Valley, whence it

passed northeastward down the St. Lawrence Valley. This disturbance was attended by general snows in the northern border States and rains elsewhere east of the Mississippi River. On the 4th advices of strong east to north winds were sent to open ports on Lake Michigan, and on the morning of the 5th southeast storm warnings were displayed on the New England coast, and southwest storm warnings along the coast from Jacksonville to New York. The disturbance increased greatly in intensity during its northeastward movement from the Lower Lakes Region and gales were general along the Atlantic coast where warnings were displayed. It was followed by rapidly rising pressure and decidedly colder weather, warnings of which had been previously issued. Storm warnings were again ordered on the north Atlantic coast on the 7th in connection with a disturbance that was then passing eastward down the St. Lawrence Valley. The center of this disturbance moved eastward north of the St. Lawrence River and although strong winds prevailed on the north Atlantic coast they were not of sufficient strength to interfere with navigation. On the 9th the disturbance was central north of Montana. This low moved eastward with great speed, reached the Lower Lakes Region in 24 hours, and thence off the New England coast. This disturbance was attended by gales in the region of the Great Lakes and off the Atlantic coast and the Virginia Capes, and northward to Eastport, Me., and it was followed by a pronounced cold wave that overspread nearly all of this country east of the Mississippi River during the 10th and 11th. Cold-wave warnings were issued to all parts of the country east of the Mississippi River in advance of its appearance.

On the morning of January 12 a belt of low pressure covered the Plains States with storm centers in Minnesota and Oklahoma; advancing eastward it was attended by snow and rain in the northern and rain in the southern States east of the Mississippi River, and passed off the Atlantic coast during the 14th. Gales attended this disturbance along the Atlantic coast, and it was followed by a pronounced change of colder weather over the districts east of the Mississippi River on the 14th and 15th. On the 14th storm warnings were displayed along the Atlantic coast from the Virginia Capes northward to Eastport, Me., and on the 12th cold-wave warnings were issued for the east Gulf States, Tennessee, and the lower Ohio Valley; and on the morning of the 13th were extended to the upper Ohio Valley, Michigan, and northwest Florida. The display of cold-wave warnings was extended to the Atlantic Coast States, except the Florida Peninsula, on the morning of the 14th. The warnings in question were verified over practically the entire region where displayed. During the 13th, 14th, and 15th the pressure rose over nearly all parts of the country, and on the morning of the 15th reached the unusual reading of 31 inches over Minnesota. This high-pressure area effectively retarded the eastward movement of the disturbance that prevailed for a number of days over the southern Rocky Mountains region. It, however, caused general rains and snows over the Southern and Southwestern States. On the 17th, owing to this abnormally low barometer along the southern border and the steep barometric gradient southward, southwest storm warnings were displayed on the Atlantic coast from Sandy Hook, N. J., to Eastport, Me.; similar conditions continuing on the 18th, the warnings remained displayed over this section of the coast, where southwest winds and moderate gales prevailed.

The most important storm of the month prevailed over the far southwest on January 19. It was central

on the morning of the 20th over southern Arizona, on the 21st over the middle Missouri Valley, and on the 22d over the northern New England States. This disturbance was attended by shifting gales and snow over all northern States east of the Rocky Mountains and by general rains in the southern States. It was followed by a pronounced cold wave which overspread the Northwestern States on the 21st, the Middle West and Southwestern States on the 22d, and the Eastern States on the 23d. Snow was particularly heavy in the upper Mississippi Valley. Advisory information of gales on Lake Michigan was sent to open ports on that lake well in advance of their occurrence, and on the morning of the 21st, when the storm center was over the Missouri Valley, storm warnings were displayed on the Atlantic coast from Cape Hatteras to Eastport, Me. Shifting gales followed during the night of the 21st and on the 22d over the region where storm warnings were displayed.

The next storm of importance to cross the Washington district occurred off the north Pacific coast on the 29th, reached the northern Rocky Mountains region on the 30th, and on the morning of the 31st was central over Illinois; thence it advanced rapidly eastward. On the morning of the 31st storm warnings were displayed on the Atlantic coast north of Sandy Hook, and on the evening of that day storm warnings were ordered for the east Gulf States and for the Atlantic coast from Atlantic City southward to Jacksonville, Fla. During that day cold-wave warnings were ordered for the entire Washington District except northern New England. This cold wave, already referred to in the special bulletin, quoted on page 20, was one of the most severe of recent years, and the warnings issued well in advance of its occurrence were fully verified. Furthermore, severe gales prevailed along the Atlantic and Gulf coasts during the following two days.

Chicago district.—Except for warnings to limited areas in the northern border States, no cold-wave warnings were issued until the evening of the 9th. During the 9–10th a disturbance of considerable intensity moved rapidly southeastward from North Dakota to southern Lake Michigan, thence eastward to the Massachusetts coast. It was followed by decidedly higher pressure and a cold wave which overspread the Missouri Valley and the districts to the eastward. Ample warning was given to practically the entire region affected.

By the morning of the 11th another rapidly moving storm was centered just north of Montana, and was followed by rapidly rising pressure from Edmonton westward over British Columbia. Accordingly cold-wave warnings were issued for Montana and northwestern North Dakota. Afternoon special reports and the regular evening reports showed a very rapid movement of weather conditions, with a high-pressure area of great magnitude overspreading the far Northwest. Warnings were therefore issued to cover all sections as far east as western Iowa and northwestern Missouri and southward to southern Kansas. During the 12th the disturbance, which had moved southeastward to Oklahoma, recurved and extended northeastward toward the Lakes region. Heavy-snow warnings were issued for limited areas in Wisconsin, Illinois, and Iowa, and the cold-wave warnings were extended over the remainder of Missouri and western Illinois. Practically all the cold-wave warnings were fully verified, while the heavy-snow warnings were only partially verified.

A storm of marked intensity moved rapidly east-northeastward during the 20th–22d from the southern Plateau

region to the St. Lawrence Valley, and was followed by a strong high-pressure area and sweeping cold wave which overspread the entire district. Timely warnings of the cold wave were issued to all portions of the district, and in addition cattle warnings were issued for the Plains States and northern Rocky Mountain region, and heavy-snow warnings for Wisconsin, eastern Minnesota, and northeastern Iowa. The snowfall was very heavy in portions of Wisconsin and Minnesota; in the vicinity of Minneapolis and St. Paul it was the heaviest in many years.

A cold-wave warning was issued for western North Dakota and northeastern Montana on the 23d, but it was only partially verified.

On the evening of the 25th a disturbance was advancing southeastward over Montana, and was followed by falling temperature and rising pressure in the Edmonton region. In anticipation of this condition extending rapidly southward, cold-wave warnings were issued for eastern Montana and extreme western South Dakota. These warnings were not verified on account of the rapid southeastward movement of a storm of marked intensity from southern Alaska.

A disturbance of marked intensity extended from the British Columbia coast southeastward over Alberta on the morning of the 27th, while an area of high pressure of great magnitude had built up over Alaska, accompanied by abnormally low temperatures. Anticipating the rapid southeastward movement of these conditions, 1 p. m. special observations were called for from the Northwest, and these seemed to confirm this expectation. Cold-wave warnings were therefore ordered for Montana, northern Wyoming, and the western portions of the Dakotas, and by the morning of the 28th the warnings were extended to cover eastern North Dakota and northern Minnesota. However, the disturbance split, one part moving rapidly eastward to Ontario and the other remaining almost stationary over British Columbia until the afternoon of the 28th. By the evening of the 28th the cold wave had reached no farther south than Havre, Mont., and Williston, N. Dak., so that warnings were repeated for western South Dakota, northern Wyoming, and most of Montana.

On the morning of the 29th cold-wave warnings were extended eastward and southward over Minnesota, eastern and northern Wisconsin, northwestern Iowa, and the northern portions of Nebraska and Wyoming; also in the portions of the Dakotas and Montana which promised a still further fall in temperature; and these warnings were repeated in the evening of the same date. The morning reports of the 30th showed that the cold wave was steadily intensifying over the entire British Northwest, and at the same time a LOW had developed over the middle Rocky Mountains region. In view of these conditions, cold-wave warnings were then extended over the Plains States to the southern limits of Kansas; in the afternoon of the same day to western Missouri; and in the evening to eastern and southern Iowa. Special warnings were also issued in the morning for stockmen to protect cattle on the ranges of South Dakota, Nebraska, Kansas, Wyoming, and Montana, as the cold was expected to be not only severe and protracted, but also accompanied by snow and high northerly winds. By the morning of the 31st the LOW had moved rapidly southeastward to the middle Mississippi valley, followed rapidly by the cold wave, as outlined by the forecasts of the previous day. The warnings were then extended over the whole of Wisconsin, Illinois, and Missouri, and

repeated in the forecasts for Iowa, Kansas, eastern Minnesota, and southeastern Nebraska, and advices issued generally that the cold wave would be severe with strong winds reaching gale force. Additional warnings were included in the evening forecasts.

The high pressure area continued to increase in magnitude, and by the evening of the 31st the conditions generally appeared to be more extensive and severe than for several years past. The warnings issued were fully verified.

In addition to the live-stock interests, railroads, transportation companies, and shippers of perishable goods were advised of the approaching conditions, and doubtless the warnings proved to be of great service. They were specially important on account of the shortage of coal in the cities of the Middle West, and in view of the warnings extra efforts were made to effect deliveries.—*Charles L. Mitchell, Assistant Forecaster.*

New Orleans district.—A noteworthy feature of the weather during January was the comparatively long duration of cloudiness, especially in the southern portion of the district. The skies failed to clear after the passage of the LOW that moved eastward over the district on the 12th–13th. In the two following days a large HIGH built up over the north-central portion of the country, drifting slowly southeastward during the 15th–17th, with east-west isobars over the Southern States. Gradients were weak for several days thereafter, and although a HIGH formed over the Great Basin and passed eastward there was not sufficient air movement to disperse the clouds. A deep LOW passed eastward over the Plains States on the 21st and the following HIGH was attended by cloudy weather. It was not until the 25th that the eastward extension of a HIGH over the extreme Southwest brought clear weather, ending a period of persistent cloudiness of two weeks' duration.

Warning of frost nearly to the coast in southern Louisiana and southeastern Texas, except the lower Rio Grande Valley, was issued on the 5th and was justified.

On the 11th an area of high pressure occupied the Plains States and Texas, and frost was forecast as on the 5th. The warning was verified in Louisiana, but the rapid southeastward movement of an area of low pressure from the Rocky Mountain region caused a rise in temperature in Texas, doubtless preventing the formation of frost.

The 8 p. m. map of Thursday, January 11, showed a strong HIGH in the Northwest, and a cold-wave warning was issued for the Texas Panhandle and western and central Oklahoma, a temperature of 10° F. being predicted for Amarillo and below 20° in Oklahoma by Saturday morning. The temperature at Amarillo Saturday morning was 12°, and in Oklahoma 14° to 20°. The warning was extended, the morning of the 12th, to include northwestern Arkansas, the remainder of Oklahoma, western Texas, and the northern and western portions of eastern Texas. At 9 p. m. it was further extended to include the remainder of the district except southeastern Louisiana; for the latter a cold-wave warning was issued on the morning of the 13th. These warnings were timely and conditions occurred as forecast except in the southern portion of western Texas and on the extreme west coast of eastern Texas. Extremely cold weather was experienced in Arkansas, but the fall was too gradual for complete verification. Northwest storm warnings for the Texas coast were ordered on the 12th at 9 p. m. Fresh to strong northerly winds occurred on the 13th as the HIGH moved southeastward, but gale

velocities were not reached. Small-craft warnings were issued for the Louisiana coast on the 12th and 13th and were justified.

On the 14th temperatures were near or below freezing in the coast sections and a warning was issued for frost or freezing temperature the following morning. Cloudiness continued, however, and the temperature rose in southern Louisiana, but continued near freezing in southeastern Texas; rain was falling at a number of stations, due to the movement of a low-pressure area apparently from the southern California coast. This low-pressure area continued eastward and caused unusually heavy snows during the late afternoon in northwestern Texas and the night of the 14-15th in Oklahoma, Arkansas, and northern Texas, for which advance warnings were issued on the afternoon of the 14th, except for Arkansas, as it was not anticipated that heavy snow would extend that far eastward. The warning of heavy snow was based on midday special observations.

A warning of freezing weather in the interior of Louisiana and southern Texas, issued on the 16th, was verified.

On the 20-21st a depression of unusual intensity and extent passed eastward from Utah, followed by a cold wave which overspread Oklahoma, Arkansas, and northern Texas on the 22d, and timely warning was issued the preceding day. The warning was extended on the 8 p. m. map of the 21st to include southern Texas and northern Louisiana, and further extended to southern Louisiana on the morning of the 22d. Northeast storm warnings were ordered for the Texas coast at 8:30 a. m. of the 22d. As the cold wave moved toward the coast general cloudiness prevailed over the district and the temperature in southern Louisiana, the southeastern portion of eastern Texas, and the southern portion of western Texas did not fall as much as was expected. The weakening of the high resulted also in the failure of the storm warning for the Texas coast, the winds being only such as would justify small-craft warnings.

Frost "if the weather clears", was forecast for the interior of Louisiana on the 23d, but the persistent cloudiness already mentioned continued on the 24th. A warning issued on the 25th for frost nearly to the coast in southern Louisiana and southeastern Texas was generally verified.

A fire-weather warning for the forested areas of Arkansas and Oklahoma was issued on the 12th, and conditions on the 13th and 14th were as forecast.

The most severe cold wave of recent years overspread the district during January 31 and February 1 and 2. Cold-wave warnings were issued for the northern portion of the district on 1 p. m. specials January 30, were extended at night to all stations except on the coast and coast stations were advised that freezing temperature would occur within 48 hours. The temperature was 18° to 26° along the west Gulf coast on the morning of February 2.

Northwest storm warnings ordered for the Louisiana and Texas coast on the afternoon of the 31st were justified.

Fire-weather warnings were issued for Arkansas and Oklahoma on the 31st for high winds and cold weather which occurred.—*R. A. Dyke, Assistant Forecaster.*

Denver Forecast District.—January was marked by high pressure in some part of the Great Basin and adjacent plateau for fully two-thirds of the month, and by a persistency of very low temperatures with slight variability in all parts of the district west of the Continental

Divide. On the eastern slope three severe cold snaps interrupted the prevailing mild weather.

On the morning of the 4th a low pressure area was central in northern Arizona, while high pressure prevailed in Nevada. The high moved southeastward and the cold-wave warnings issued for northeastern Arizona, southwestern Colorado, and northern New Mexico were justified except in northeastern New Mexico. During the 11th a low center moved from Alberta southward along the eastern Rocky Mountain slope, the low center overlying eastern Colorado at the time of the p. m. observation of the 11th, while rapidly rising pressure was general in northwestern districts. Cold-wave warnings were issued for eastern Colorado and were fully justified. Warnings of a cold wave were issued on the morning of the 15th for western Colorado, northern New Mexico, northeastern Arizona, and eastern Utah, and repeated the following morning for practically the same area. The warnings failed of justification, the strong pressure on the eastern slope blocking the movement of the low eastward, while the high pressure in the rear of the low failed to force the latter southward into Mexico, as sometimes occurs when there is a barometric barrier on the eastern slope. The low persisted in northern Arizona despite the fact that pressures were losing intensity on the eastern slope and increasing in intensity northwest of the low center. On the morning of the 20th a low pressure area was central in northern Arizona, while moderately high pressure overlay the Pacific northwest. The low moved northeastward through Colorado. Cold-wave warnings were issued for southwestern Colorado, northern Arizona, and southern Utah. The warnings were verified, except in southwestern Colorado. The evening chart of the 20th showed the low center in Colorado with indications of a rapid eastward movement. Cold-wave warnings were issued for Colorado, northern New Mexico, northeastern Arizona, and eastern Utah. The warnings were fully verified. In the afternoon of the 21st the warning was repeated for northeastern New Mexico and extended to southeastern New Mexico. The warnings were verified. The warnings issued on the morning of the 28th for a cold wave in northeast Colorado were premature, as also that issued the following morning for eastern Colorado, the northwestern low failing to move as rapidly as expected. Warnings of a cold wave for Colorado were issued on the morning of the 30th, and in the afternoon were extended to northern New Mexico, southern and eastern Utah, and 12 hours later repeated for southern Colorado, northern New Mexico, southeastern Utah, and extended to northeastern Arizona. At the time the earlier warnings were issued low pressure still prevailed northwest of the district and the front of the anticyclone was north of Montana. The later warnings were fully verified. On a number of dates the forecasts included advices of freezing temperature in southeastern Arizona.—*Frederick H. Brandenburg, District Forecaster.*

Portland, Oreg., district.—January, 1917, was less stormy than usual, and the recorded precipitation was considerably less than the normal except in southeastern Idaho, where at Pocatello it was about 23 per cent above normal. Temperatures during the first decade and most of the last decade averaged above normal, but during the middle of the month the weather generally was abnormally cold, and fair. From the 1st to the 10th and from the 20th to the 31st the weather in this district was influenced principally by the North Pacific low-pressure areas, while

the influence of the high-pressure areas predominated generally from the 11th to the 19th.

On nine occasions storm warnings were ordered for one or more stations, and similarly small-craft warnings were ordered displayed on eight occasions. Three warnings for cold waves were given out. Of the storm warnings issued, those of the 3d, 4th, 26th, 28th, and 31st were fully verified; those of the 6th, 27th, and 29th were verified except in one or two instances. On three dates verifying velocities occurred without warnings as follows: Seattle, 36 miles per hour from the south on the 3d; Tacoma, 28 miles from the southwest on the 25th, and at North Head and Tatoosh Island, 52 miles from the west on the 29th. On the 25th and 29th the necessity for ordering up warnings was not apparent from a study of the morning forecast charts; no reported damage resulted, however.

The small-craft warnings sent out on the 1st, 3d, 5th, 6th, 8th, 22d, 30th, and 31st were, so far as could be learned, timely and necessary.

Cold-wave warnings were issued on the 10th, 29th, and 30th. Although the weather became considerably colder on the last two dates, no verification was secured, and the warning of the 10th was only partially verified. The warning of the 10th was for southern Idaho, that of the 29th for sections east of the Cascade Mountains, and the last one was for Idaho. On the 13th a cold wave overspread southeastern Idaho, due to the clearing skies and unusually rapid radiation; the fall of exactly 20 degrees was reached.

Cautionary warnings for temperatures near or below 0° F. were telegraphed to Mr. Wilmer Sieg, Hood River, Oreg., on the 10th, 13th, 15th, 17th, and 29th. In testifying to the usefulness of these warnings to fruit shippers, Mr. Sieg wrote on January 20 as follows:

There are still from four to five hundred cars of apples here, and we will be shipping into April, and I would like to see the weather reports continued just so long as we are in danger from low temperatures through your district. This report has been of great service and guidance to us, fully appreciated, and if it can be continued until we are on a basis of safe temperatures we will appreciate it.

—*T. Francis Drake, Assistant Forecaster.*

San Francisco district.—The month was abnormally clear and cold throughout this district, and killing frosts and freezing weather occurred in California with a frequency probably never before recorded. Warnings of killing frosts were issued many times during the month and in most instances were verified and timely.

Rain began in the extreme north on the afternoon of the 1st and extended over California, and snow fell in Nevada on the 2d and 3d. Rain again fell in northern California and snow in northern Nevada on the 5th; in the southern portion of northern California on the 12th; in southern California on the 12th, 13th, and 15th, and from the 17th to the 20th. The rain warnings were only fairly successful.

Cold-wave warnings were issued in Nevada on the morning of the 30th, and they were fully verified.—*G. H. Willson, District Forecaster.*